

Quiz No. 1

Name SOLUTION

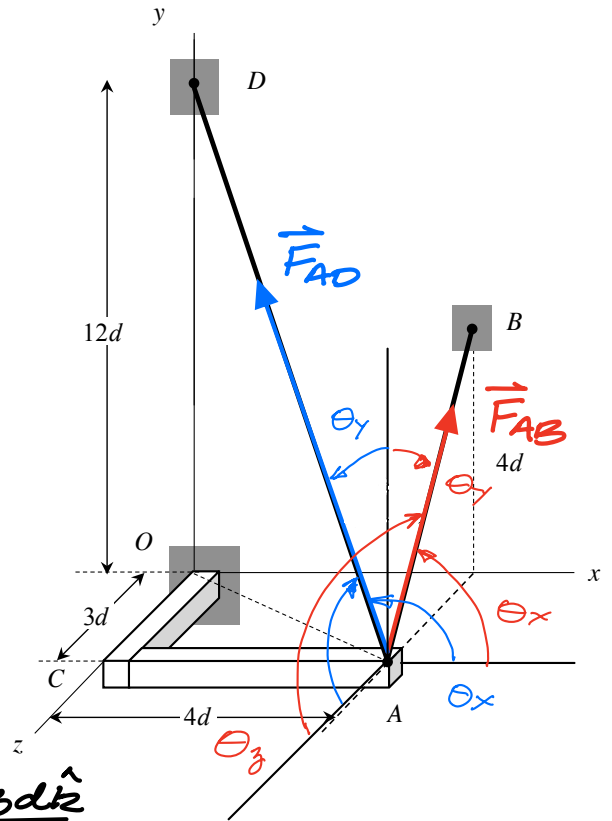
ME 270 - Summer 2024 - Prague

**Given:** Pre-tensioned cables AB and AD, having tensions of  $2T$  and  $T$ , respectively, are attached to end A of the L-shaped bracket and exert forces of  $\vec{F}_{AB}$  and  $\vec{F}_{AD}$ , respectively, on the bracket due to these tensions.

**Find:**

- Calculate the direction angles for  $\vec{F}_{AD}$ . Show these angles in the figure.
- Calculate the direction angles for  $\vec{F}_{AB}$ . Show these angles in the figure.

Solution



$$a) \vec{F}_{AD} = F_{AD} \hat{u}_{AD}$$

$$w/ \hat{u}_{AD} = \frac{\vec{r}_{AD}}{|\vec{r}_{AD}|} = \frac{-4d\hat{i} + 12d\hat{j} - 3d\hat{k}}{\sqrt{4^2 + 12^2 + 3^2}}$$

$$= -\frac{4}{13}\hat{i} + \frac{12}{13}\hat{j} - \frac{3}{13}\hat{k}$$

$$\therefore \cos\theta_x = -\frac{4}{13} \Rightarrow \theta_x = 107.9^\circ$$

$$\cos\theta_y = \frac{12}{13} \Rightarrow \theta_y = 22.6^\circ$$

$$\cos\theta_z = -\frac{3}{13} \Rightarrow \theta_z = 103.3^\circ$$

$$b) \vec{F}_{AB} = F_{AB} \hat{u}_{AB}$$

$$w/ \hat{u}_{AB} = \frac{\vec{r}_{AB}}{|\vec{r}_{AB}|}$$

$$= \frac{4d\hat{j} - 3d\hat{k}}{\sqrt{(4d)^2 + (3d)^2}} = \frac{4}{5}\hat{j} - \frac{3}{5}\hat{k}$$

$$\therefore \begin{cases} \cos\theta_x = 0 \Rightarrow \theta_x = 90^\circ \\ \cos\theta_y = \frac{4}{5} \Rightarrow \theta_y = 36.87^\circ \\ \cos\theta_z = -\frac{3}{5} \Rightarrow \theta_z = 126.87^\circ \end{cases}$$